Wood Island Feasibility Study

Part Two Appendices

April 2009

Completed for the Town of Kittery, Maine in cooperation with the University of New Hampshire and Appledore Engineering, Inc.

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Table of Contents

A. Structure Assessment Appendix

Mary Ferguson, Krystian Kozlowski

Structure Assessment Appendix Contents

Preliminary Abatement Analysis

Terracon

ASSUMED ASBESTOS-CONTAINING MATERIALS
Wood Island
Kittery, ME

Description	Material Location	Percent/Type Asbestos	NESHAP Classification	Condition	Estimated Quantity
Life Boat Station: Basement					
Pipe insulation	Main basement Boiler room	Assumed ACM	Friable ACM	Significantly damaged	260 LF 20 LF
Pipe fitting insulation	Main basement Boiler room	Assumed ACM	Friable ACM	Significantly damaged	50 Fittings 50 Fittings
Boiler insulation	Boiler room	Assumed ACM	Friable ACM	Significantly damaged	50 ft^2
Tank insulation	Boiler room	Assumed ACM	Friable ACM	Significantly damaged	60 ft^2
Gypsum board	Main basement Boiler room	Assumed ACM	Friable ACM	Significantly damaged	10 ft^2 12 ft^2
Stair tread cover	Main basement	Assumed ACM	Category I Non-Friable	Good	8 ft^2
Electric wire wrap	Throughout	Assumed ACM	Category II Non-Friable	Good	Unknown
TSI insulation debris	Main basement Boiler room	Assumed ACM	Friable ACM	Significantly damaged	2,300 ft^2 180 ft^2
Sheet flooring	Main basement:: Debris on floor at base of stairs	Assumed ACM	Category I Non-Friable	Significantly damaged	10 ft^2
Life Boat Station: 1st floor					
Pipe insulation	Boat house: Riser	Assumed ACM	Friable ACM	Significantly damaged	4 LF
Plaster with skim coat	Station	Assumed ACM	Friable ACM	Significantly damaged	5,440 ft^2
Sheet flooring: Canvas backed	Station: Throughout	Assumed ACM	Category I Non-Friable	Damaged	1,200 ft^2
Flooring paper	Station Boat house	Assumed ACM	Friable ACM	Damaged	1,450 ft^2 1,550 ft^2
Electric wire wrap	Throughout	Assumed ACM	Category II Non-Friable	Good	Unknown
Life Boat Station: 2nd floor					
Plaster with skim coat	Throughout	Assumed ACM	Friable ACM	Significantly damaged	3,600 ft^2
Flooring paper	Throughout	Assumed ACM	Friable ACM	Damaged	3,600 ft^2
Stair tread cover	Stairwell	Assumed ACM	Category I Non-Friable	Good	1 ft^2
Electric wire wrap	Throughout	Assumed ACM	Category II Non-Friable	Good	Unknown

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Geotechnical ■ Environmental ■ Construction Materials ■ Facilities

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ASSUMED ASBESTOS-CONTAINING MATERIALS, continued
Wood Island
Kittery, ME

Description	Material Location	Percent/Type Asbestos	NESHAP Classification	Condition	Estimated Quantity
Life Boat Station: Exterior					
Siding Paper	Exterior	Assumed ACM	Friable ACM	Damaged	4,600 ft^2
Asphalt roof shingles	Exterior	Assumed ACM	Category I Non-Friable	Damaged	4,200 ft^2
Tool house					
Siding Paper	Exterior	Assumed ACM	Friable ACM	Damaged	480 ft^2

ft^2 = square feet
lf = linear feet
Friable: Includes materials that, when dry, may be crumbled, pulverized or reduced to powder by hand pressure.
Category I: Includes asbestos-containing packings, gaskets, asphaltic roofing products, resilient flooring, pliable sealants and pliable mastics.
Category II: Includes any non-friable materials other than Category I materials that contain more than 1% asbestos.
ACM: Asbestos containing material. Material that contains greater than 1% asbestos content.

Design Calculations

Preservation of Current Condition Option Calculations

MARY FERGUSON | WOOD ISLAND | RESTORATION OPTION

WINDOW STEEL PLATING

LOAD DEVELOPMENT:

1. $V = 100$ mph

   $K_d = 0.85$, SOLID SIGNS ASCE 7-05 T6-4

2. $I = 1.00$, CATEGORY II ASCE 7-05 T1-1 & 6-1

3. $K_{0-15} = 1.03$, EXPOSURE D ASCE 7-05 T6-3

4. $K_{zt} = (1 + K_1 K_2 K_3)^2 = 1$ ASCE 7-05 F6-4

5. $G = 0.85$ ASCE 7-05 Sect 6.5.8

6. ENCLOSED. ASCE 7-05 Sect. 6.2

7. $GC_{pi} = \pm 0.18$ ASCE 7-05 F6-5

8. C_f : CASE A ASCE 7-05 F6-20

b	s	h	b/s	s/h	Cf
3.00	3.40	9.90	0.88	0.34	1.80
3.60	6.00	10.30	0.60	0.58	1.70
3.90	7.20	8.10	0.54	0.89	1.60
9.00	7.50	14.00	1.20	0.54	1.75
3.40	5.50	9.80	0.62	0.56	1.75
4.40	3.80	7.80	1.16	0.49	1.75
5.00	3.70	13.00	1.35	0.28	1.80
9.10	10.40	13.30	0.88	0.78	1.65
3.50	3.90	12.90	0.90	0.30	1.80
3.90	7.60	11.60	0.51	0.66	1.70
3.20	5.70	12.20	0.56	0.47	1.75

9. $q_z = 0.00256\, K_z K_{zt} \cdot K_d \cdot V^2 \cdot I$ ASCE 7-05 EQ 6-15

   $= 0.00256(1.03)(1.00)(0.85)(100)^2(1.00) = 22.4$

10. $p = q_z \cdot G \cdot C_p = 22.4(0.85)(1.80) = 34.3$ psf ASCE 7-05 EQ 6-17

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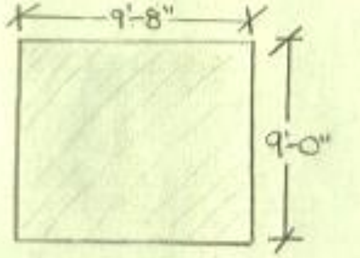
WINDOW STEEL PLATING:

THICKNESS DESIGN:

SOUTH GARAGE DOOR:



$P = 34.3$ psf

$P_u = 1.6(34.3\text{ psf}) = 54.9$ psf

$= 7.90$ KSI (AISC pg 2-8)

$t_{req'd} = \ell \cdot \sqrt{\frac{2P_u}{0.9F_y BN}}$ (AISC 14.5)

$\ell = \text{MAX}\begin{cases} m = [N - 0.95d]/2 \\ n = [B - 0.80 b_f]/2 \\ \lambda n' = [\lambda \sqrt{d b_f}]/4 \end{cases}$

$N = (9'\text{-}0") + 4" = 112"$

$B = (9'\text{-}8") + 4" = 120"$ (ASSUMING 4" OVERHANG)

$\lambda = \frac{2\sqrt{x}}{1 - \sqrt{1-x}} \le 1$ $\quad x = \left[\frac{4db_f}{(d+b_f)^2}\right]\frac{P_u}{\phi_c P_p}$ → NA ∴ $\lambda = 1$ TO BE CONSERVATIVE

$m = [112" - 0.95(108")] = 9.4"$

$n = [120" - 0.80(116")] = 27.2"$

$\lambda = (1)\sqrt{(108")(116")}/4 = 28.0"$

$t_{req'd} = (28.0)\sqrt{\frac{2(7.90\text{ KSI})}{0.9(36\text{ KSI})(112")(120")}} = 0.1687 = \frac{3}{16}"$

USING A36 STEEL, $F_y = 36$ KSI (AISC T2-3)

APPROX COST: \$9.19 /SF + \$10/plate

APPROX WT: $0.284\frac{lb}{in^3}\left(\frac{3}{16}in\right)\left(144\frac{in^2}{ft^2}\right) = 7.68\frac{lb}{ft^2}$

$= (9'\text{-}8")(9')(7.68\frac{lb}{ft^2}) = 717$ lb.

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P1316	3/16 inch THICK A36 Steel Plate	1 X 2 Ft.	1	In Stock	$28.38	$28.38	Change
P1316	3/16 inch THICK A36 Steel Plate	1 X 1 Ft.	1	In Stock	$19.19	$19.19	Change
			Total:			$94.33	Empty Cart
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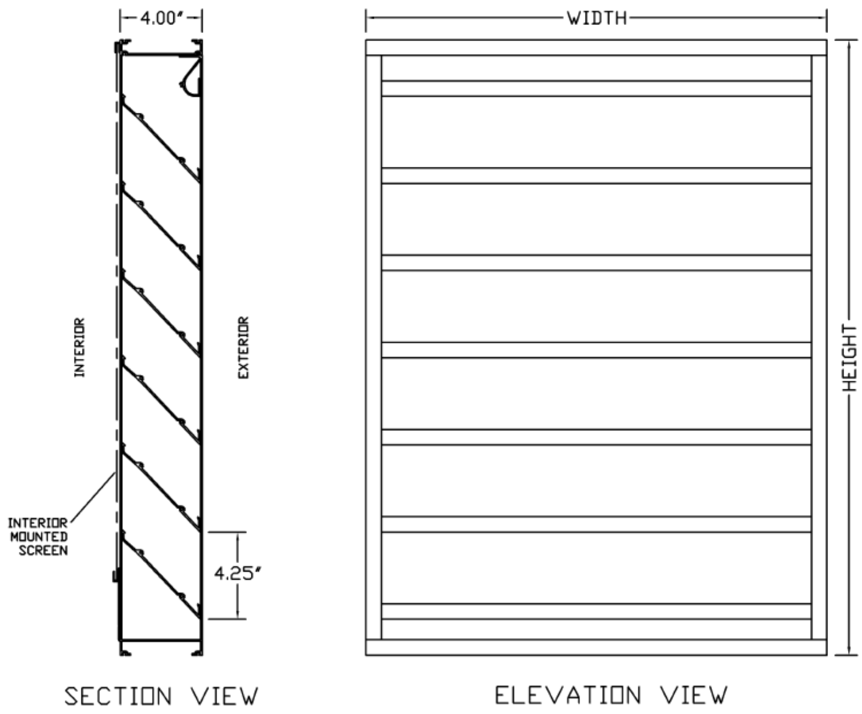
1 of 1 3/29/2009 10:41 PM

E4DS - 4" DEEP 45 DEGREE DRAINABLE D BLADE EXTRUDED ALUMINUM STATIONARY LOUVER



BLADE - 0.081" THICKNESS TYPE 6063-T5 EXTRUDED ALUMINUM

FRAME - 0.081" THICKNESS TYPE 6063-T5 EXTRUDED ALUMINUM

DESIGNED FOR 100 MPH WIND LOAD

SIZES 12" WIDE X 12" HIGH UP TO UNLIMITED SIZE AVAILABLE

OPTIONS:

MOUNTING FOR VARIOUS OPENING TYPES (SEE FRAME STYLES BELOW)

ARCHITECTURAL SHAPES (SEE SPECIAL SHAPES TECH SHEET)

HIGHER WIND LOAD RATINGS

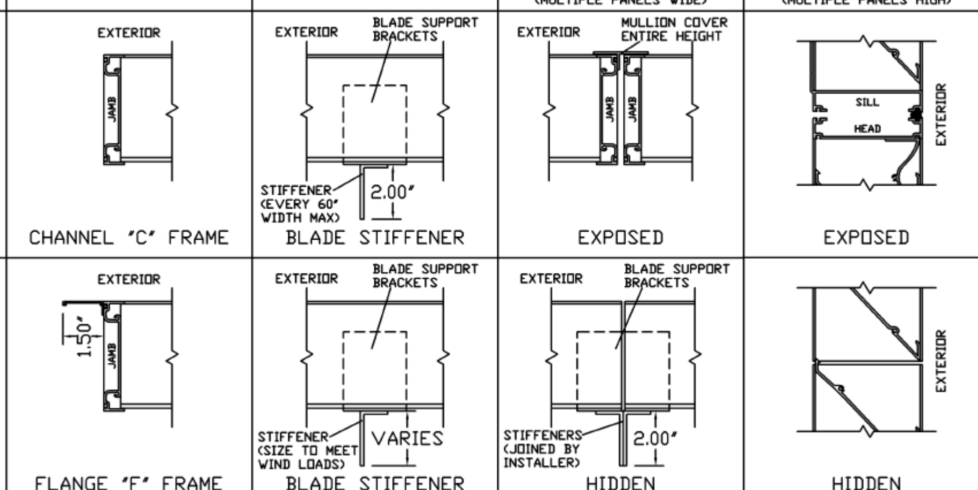
ARCHITECTURAL FINISHES

VARIOUS SCREENS

* SEE MOUNTING OPTIONS TECHNICAL SHEET FOR MORE FRAME STYLES:

1. J-CHANNEL FOR SIDING OR STUCCO
2. G-CHANNEL FOR GLAZING INTO STOREFRONT OR CURTAINWALL

CONSTRUCTION	FRAME STYLE *	STIFFENER	VERTICAL MULLION (MULTIPLE PANELS WIDE)	HORIZONTAL MULLION (MULTIPLE PANELS HIGH)
STANDARD	CHANNEL "C" FRAME	BLADE STIFFENER	EXPOSED	EXPOSED
OPTIONAL	FLANGE "F" FRAME	BLADE STIFFENER	HIDDEN	HIDDEN

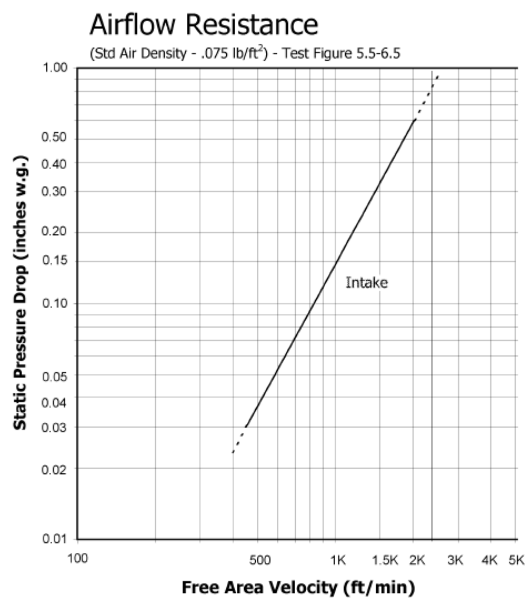


ARCHITECTURAL LOUVERS
266 West Mitchell Ave - Cincinnati, OH 45232
PH: (888) 568-8371 Fax: (888) 568-8370

PROJECT			
CONTRACTOR			
ARCHITECT			
DRAWN BY: JRR	DATE: 08/2007	DRAWING TYPE: TECHNICAL SHEET	DRAWING TITLE: E4DS

MODEL: E4DS Louver Performance Data

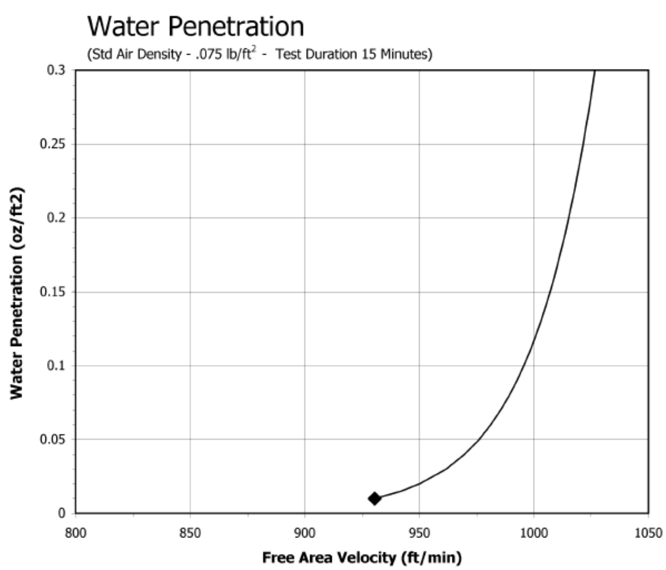
The Architectural Louvers Model E4DS is tested in accordance with AMCA 500-L Laboratory Methods of Testing Air Louvers for Rating. The data presented are the results of these tests. Tested louver size is 48" wide x 48" high and does not include the effects of bird screen.



amca CERTIFIED RATINGS
WATER PENETRATION AIR PERFORMANCE
AIR MOVEMENT AND CONTROL ASSOCIATION INTERNATIONAL, INC.®

Architectural Louvers certifies that model E4DS louver shown herein is licensed to bear the AMCA seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 511 and comply with the requirements of the AMCA Certified Ratings Program. The AMCA Certified Ratings Seal applies to air performance ratings and water penetration ratings only.

Model: E4DS resistance to airflow
Free area velocities (shown left) are higher than average face velocity or duct velocity. See louver application information.



The AMCA Water Penetration Test provides a method for comparing various louver models and designs as to their efficiency in resisting the penetration of rainfall under specific laboratory test conditions. The point of zero water penetration is defined as that velocity where the water penetration curve projects through .01 oz. of water (penetration) per sq. ft. of louver free area. The beginning point of water penetration for this Model E4DS is 930 fpm free area velocity. These performance ratings do not guarantee a louver to be weatherproof or stormproof and should be used in combination with other factors in selecting louvers (i.e. prevailing wind direction, weather patterns for the building location area, desired safety factor, etc.).

November 2007

MODEL: E4DS Louver Application Guide

Application of air louvers involves selecting an airflow velocity through the louver free area (free area velocity in fpm) that produces an acceptable pressure drop and for intake applications minimizes carry-over of normally occurring rain. Architectural Louvers does not warrant our louvers to prevent water penetration under all combinations of wind and rain. Water penetration through Model E4DS begins at 930 fpm free area velocity. Intake air louver selection using a free area velocity below 930 fpm is recommended. Louver selection involves the following steps, and depending on the information provided, either step may come first.

Select Free Area Velocity - Fan Forced Intake:

Using the Airflow Resistance Chart, select a free area velocity that produces an acceptable pressure drop with minimal water penetration. (Water penetration is not typically considered when selecting exhaust louvers.)

Determine Louver Free Area:

Using the free area velocity from previous step and total cfm, determine the louver Free Area required. Using louver Free Area Chart, select a louver with the required free area. If louver size is given, determine free area from chart and work backwards to determine maximum airflow. See examples below.

Free Area Chart (ft^2)

Louver Height (Inches) \ Louver Width (Inches)	12	24	36	48	60	72	84	96
12	0.38	0.82	1.26	1.70	2.13	2.52	2.95	3.39
24	0.89	1.90	2.92	3.94	4.95	5.84	6.86	7.87
36	1.52	3.25	4.99	6.72	8.46	9.97	11.71	13.44
48	2.02	4.34	6.65	**8.96**	11.27	13.30	15.61	17.92
60	2.53	5.42	8.31	11.20	14.09	16.62	19.51	22.41
72	3.04	6.50	9.97	13.44	16.91	19.95	23.42	26.89
84	3.54	7.59	11.64	15.68	19.73	23.27	27.32	31.37
96	4.17	8.94	13.70	18.47	23.24	27.41	32.17	36.94

Louver Selection Examples - Fan Forced Intake:

Example 1:
Airflow given as 6000 cfm (fan volume)– select louver size.

A. Determine louver free area by dividing airflow by free area velocity (do not exceed 930 fpm on intake louver applications).

cfm / fpm = ft^2
6000 / 930 = 6.45

B. Select a louver with at least the required louver free area from Free Area Chart above.

Width x Height — Free Area from Chart
48 x 36 — 6.63
(Other selections available – See Free Area Chart above)

C. Calculate Free Area Velocity

fpm = cfm / ft^2 free area of louver
905 = 6000 / 6.63

D. Check the pressure drop of the selected louver at the calculated airflow (Airflow Resistance Chart on Page 2).

in w.g. = 0.120 at 905 fpm free area velocity

Example 2:
Louver size given as 96 W x 48 H – determine maximum airflow.

A. Use Free Area Chart to obtain ft^2 for given size

Free Area = 17.92 sq ft

B. Multiply Free Area x Free Area Velocity (Do not exceed 930 fpm on intake louver applications).

ft^2 x fpm = cfm
17.92 x 930 = 16670

C. Check the pressure drop of the selected louver at the calculated airflow (Airflow Resistance Chart on Page 2).

in w.g. = 0.127 at 930 fpm free area velocity

November 2007

Steel Frame Option Calculations

Wind Load Development

1. Basic Wind Speed, V = 100 mph — ASCE 7-05 Figure 6-1C
   Wind Directionality Factor, Kd = 0.85
   For Open Signs and Lattice Framework — ASCE 7-05 Table 6-4

2. Importance Factor, I = 0.87 — ASCE 7-05 Table 1-1

3. Exposure Category: D
   Flat, Unobstructed Areas Exposed to
   Wind flowing over open water — ASCE 7-05 6.5.6.2

Height above ground, ft	Exposure D (Case 1&2)
0-15	1.03
20	1.08
25	1.12
30	1.16
40	1.22

4. Topographic Factor, k_{zt} = 1
   Structure is not on a hill — ASCE 7-05 6.5.7

5. Gust Effect Factor, G_f = 0.85 — ASCE 7-05 6.5.8

6. Enclosure Classification, OPEN — ASCE 7-05 6.5.9, 6.2

7. Internal Pressure Coefficient, GC_{pi} = 0.00 — ASCE 7-05 6.5.11.1 Figure 6-5

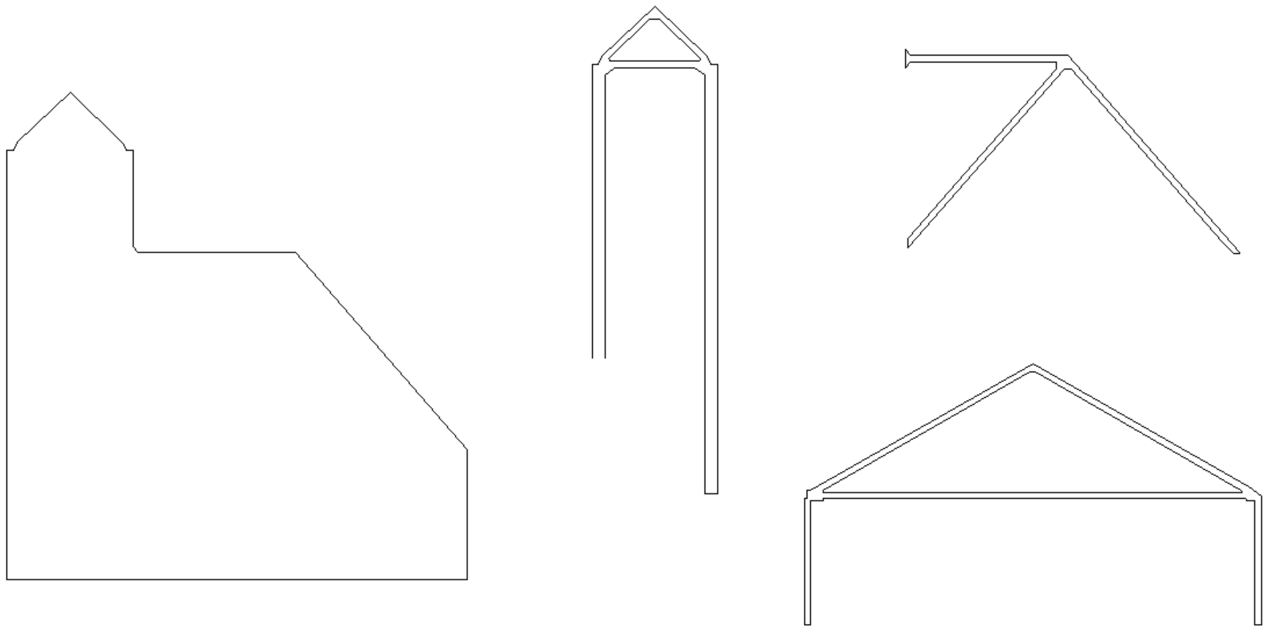
8. External Force Coefficient, C_f — ASCE 7-05 6.5.11.3
   Areas

   Tower:
   Nominal/Projected Normal Solid Area: 95.19 sq ft

   Boathouse:
   Nominal/Projected Normal Solid Area: 66.29 sq ft

   Station House:
   Nominal/Projected Normal Solid Area: 36.40 sq ft

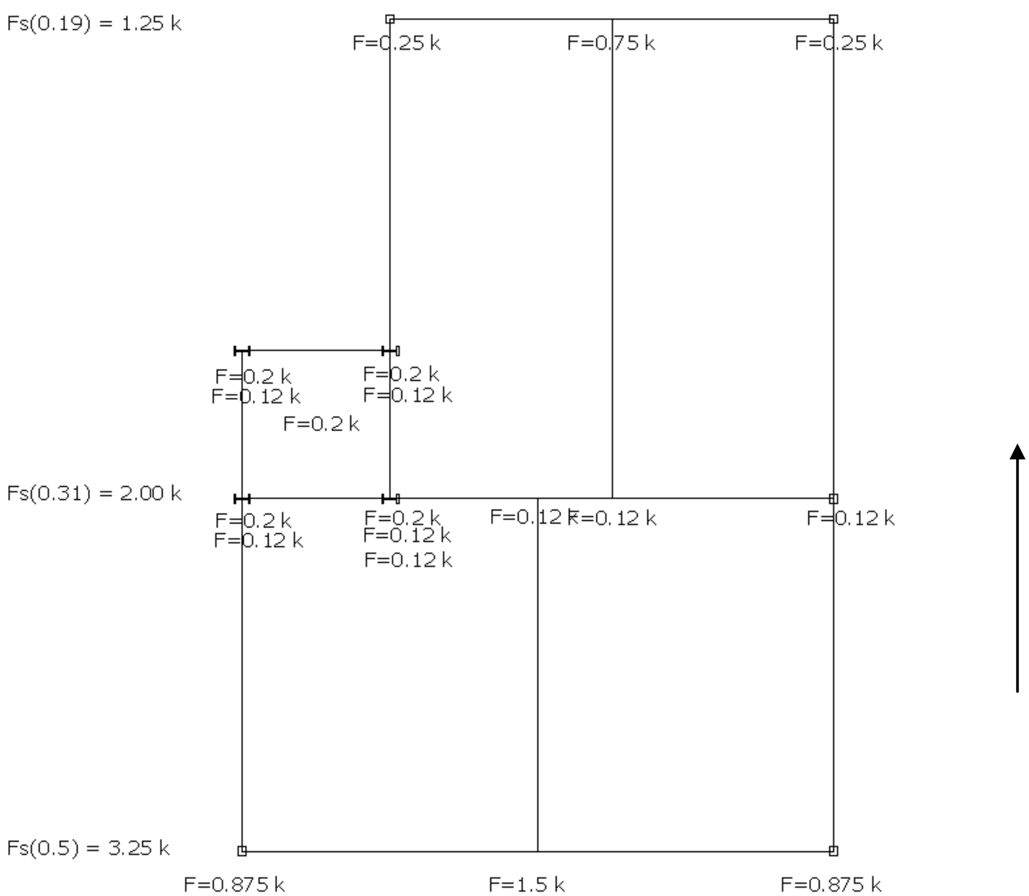
   Total Nominal/Normal Solid Area: 197.88 sq ft
   Gross Nominal/Normal Building Area: 1301 sq ft
   Epsilon: 0.152



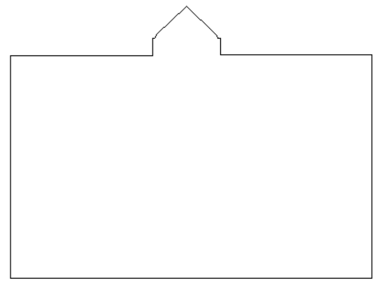
Force Coefficient, Cf = 1.8   ASCE 7-05, Table 6-22

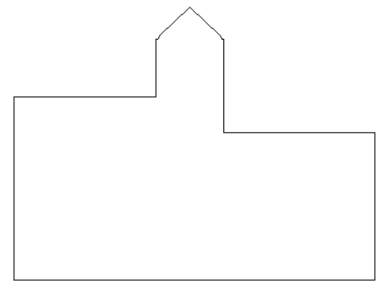
Applied Wind Force = 6.50 kips   ASCE 7-05, Eqn 6-28

Force Distribution Method adapted from ANSI A58-1



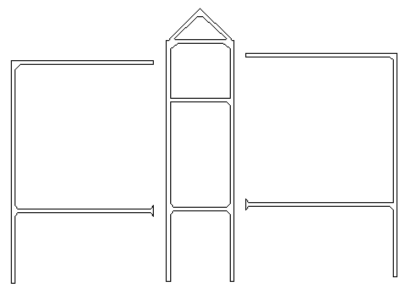
Areas





Tower:
Nominal/Projected
Normal Solid Area:
83.32 sq ft

Boathouse:
Nominal Solid Area:
50.50 sq ft
Projected Normal Solid
Area: 43.17 sq ft



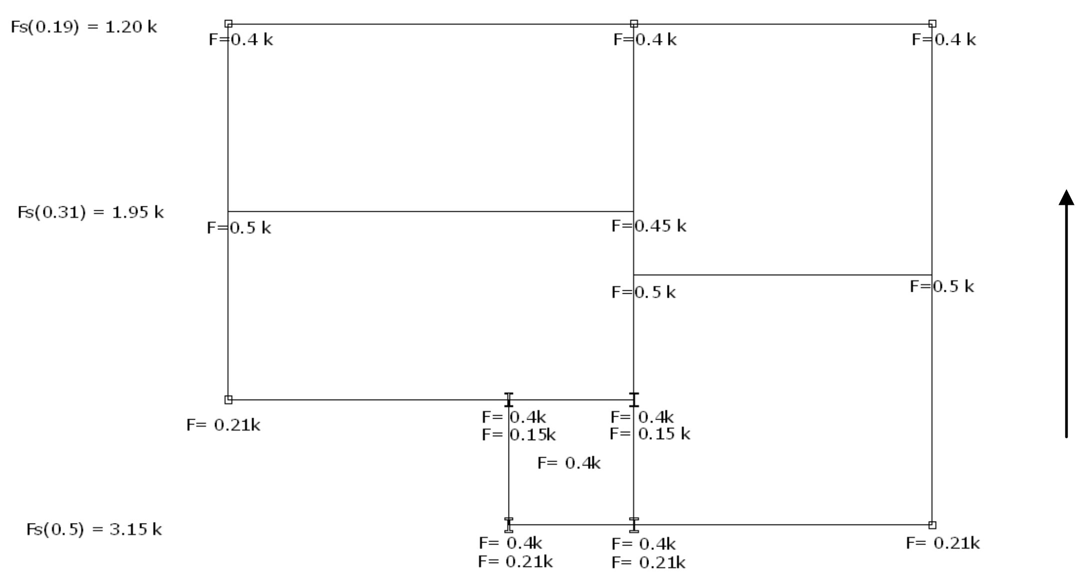
Station House:
Nominal Solid Area:
49.90 sq ft
Projected Normal Solid
Area: 45.29

Total Solid Area: 183.72 sq ft
Total Projected Normal Solid Area: 171.78 sq ft
Gross Nominal Building Area: 2255 sq ft
Epsilon: 0.0814

Force Coefficient, Cf = 2.0   ASCE 7-05, Table 6-22

Applied Wind Force = 6.30 kips   ASCE 7-05, Eqn 6-28

Force Distribution Method adapted from ANSI A58-1



Dead Load Development

Initial Try Sections: HSS 7x7x1/2 and W16x50

Dead Load: HSS Section: 41 lb/lft

Dead Load: Wide Flange Section: 50 lb/lft

Snow Load Development

Neglect snow load

Consider worst case: 0.5" ice build up covering all members (entire surface area).

Assume: Density of ice: 57.25 lb/ft3

Total Surface Area:

(1000 lft)(0.583)(4)=2333 ft2

(2333ft2)(0.833ft)(5725lb/ft3)=11130lb

Total Ice Load: 11.13 lb/lft

Live Load Development

Assume only live load due to seagulls negligible.

Unfactored Loads ASCE 7-05

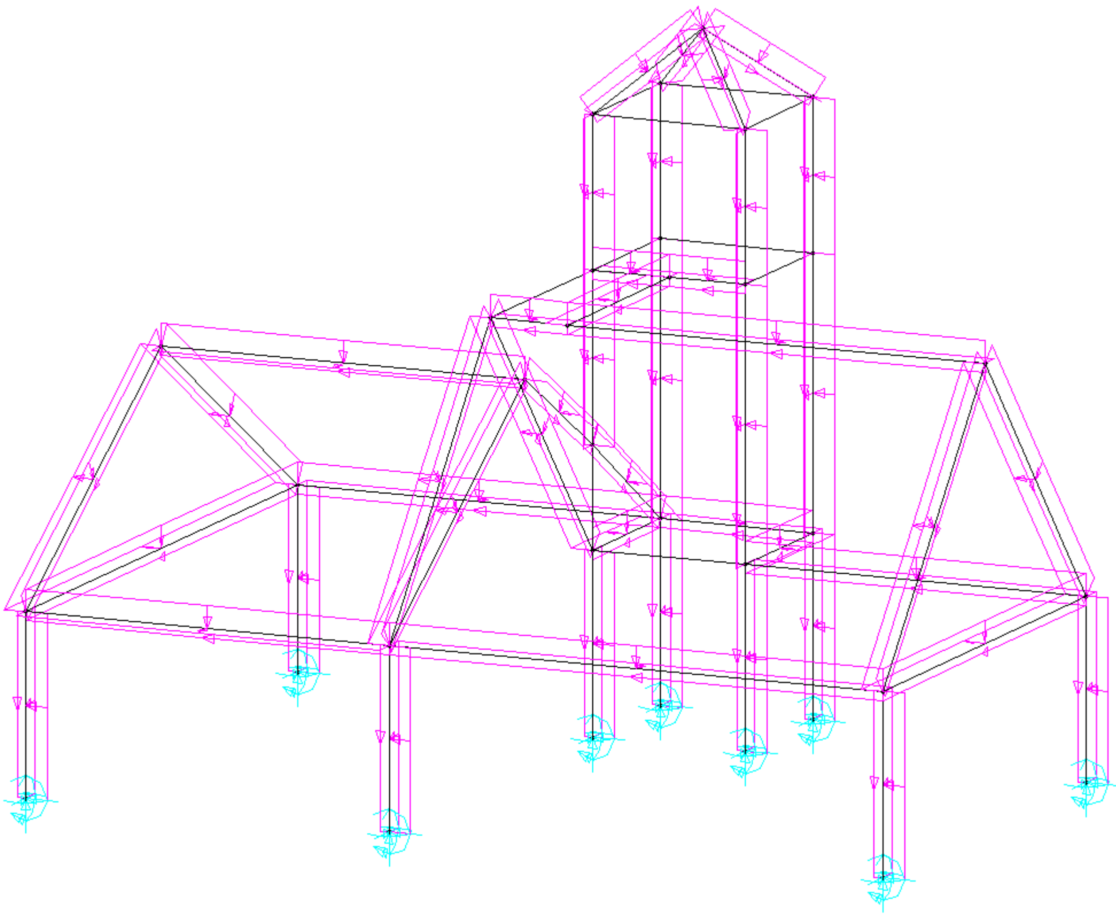
Wind	21.29 lb/lft
Snow	11.13 lb/lft
Dead	41.91 lb/lft 53.00 lb/lft
Live	Negligible
Seismic	Not considered

Design Loads AISC 2-8 Load Case 4

Wind	34.06 lb/lft	
Snow	5.57 lb/lft	
Dead	50.29 lb/lft	HSS7x7x1/2
	50 lb/lft	W16x50
Live	Negligible	
Seismic	Not considered	

Structural Analysis

The design loads were used to perform a matrix structural analysis on the design frame. The analysis revealed the nodal deformations of the structure under maximum loading.



The following data represents the movements of the frame and the rotations that each moment connection must be designed for.

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***********   MASTAN2 v3.2.0   ***********

 Time:  12:17:47      Date:  04/21/2009

 Problem Title:   Wood Island Steel Frame
                  **************
```

###############################
Results of Structural Analysis
###############################

General Information:
Structure Analyzed as: Space Frame
Analysis Type: First-Order Elastic

Analytical Results:

(i) Displacements at Step # 1, Applied Load Ratio = 1.0000

Deflections

Node	X-disp	Y-disp	Z-disp
1	-7.3263e-002	-1.2307e-001	-6.6883e-002
2	-1.1297e-001	-1.5624e-001	-5.8440e-002
3	-5.7315e-002	-1.8373e-001	-1.0155e-001
4	-5.9415e-002	-3.8954e-002	-1.0556e-001
5	-7.3320e-002	-1.4269e-001	-1.0613e-001
6	-1.3326e-001	-2.5390e-001	-1.2900e-001
7	-1.3102e-001	-9.1532e-002	-7.8685e-002
8	-1.7190e-001	-1.2084e-001	-5.3753e-002
9	-4.9841e-001	-2.7137e-001	-1.2045e-001
10	-4.8462e-001	-3.5906e-001	-2.8348e-001
11	-4.3811e-001	-3.4548e-001	-7.3746e-001
12	-4.4764e-001	-2.0355e-001	-6.5686e-001
13	-4.9720e-001	-1.8476e-001	-7.3723e-001
14	-4.9602e-001	-6.3450e-003	-6.7241e-001
15	-5.5479e-001	-1.8109e-001	-7.9088e-001
16	0.0000e+000	0.0000e+000	0.0000e+000
17	0.0000e+000	0.0000e+000	0.0000e+000
18	0.0000e+000	0.0000e+000	0.0000e+000
19	0.0000e+000	0.0000e+000	0.0000e+000
20	0.0000e+000	0.0000e+000	0.0000e+000
21	0.0000e+000	0.0000e+000	0.0000e+000
22	0.0000e+000	0.0000e+000	0.0000e+000
23	0.0000e+000	0.0000e+000	0.0000e+000
24	0.0000e+000	0.0000e+000	0.0000e+000
25	-6.0375e-002	-9.6966e-002	-1.0465e-001
26	-2.8010e-001	-3.0228e-001	-5.0730e-001
27	-3.1827e-001	-1.9256e-001	-3.5759e-001
28	-4.8675e-001	-4.3160e-001	-2.5510e-001
29	-3.1609e-001	-1.6797e-001	-5.0851e-001
30	-3.1187e-001	-2.2153e-002	-4.6233e-001
31	-1.5337e-001	-1.7371e-001	-1.8212e-001
32	-3.7245e-001	-3.1696e-001	-2.3470e-001
33	-5.1078e-001	-2.8228e-001	-1.1107e-001

Rotations (radians)

Node	X-rot	Y-rot	Z-rot
1	-1.2058e-002	7.4093e-003	5.2015e-003
2	2.5995e-003	-4.3462e-003	6.9624e-003
3	-1.0348e-002	-1.2659e-003	7.7390e-003
4	-1.2302e-002	-7.2938e-004	8.1229e-003
5	-1.2786e-002	4.9503e-003	9.9959e-003
6	2.2243e-004	-2.6785e-003	1.1782e-002
7	-1.7039e-002	5.0802e-003	1.3322e-002
8	7.0242e-003	-3.9842e-003	1.8093e-002
9	-1.3520e-003	2.8688e-003	4.9466e-003
10	-6.7980e-003	5.2985e-003	1.5661e-002
11	-1.6580e-002	-6.8230e-003	1.5672e-002
12	-2.2561e-002	-6.3074e-003	1.3201e-002
13	-1.6942e-002	-5.7410e-003	1.8036e-002
14	-1.7679e-002	-5.2552e-003	1.8273e-002
15	-1.6901e-002	-5.9771e-003	1.6512e-002
16	0.0000e+000	0.0000e+000	0.0000e+000
17	0.0000e+000	0.0000e+000	0.0000e+000
18	0.0000e+000	0.0000e+000	0.0000e+000
19	0.0000e+000	0.0000e+000	0.0000e+000

20	0.0000e+000	0.0000e+000	0.0000e+000
21	0.0000e+000	0.0000e+000	0.0000e+000
22	0.0000e+000	0.0000e+000	0.0000e+000
23	0.0000e+000	0.0000e+000	0.0000e+000
24	0.0000e+000	0.0000e+000	0.0000e+000
25	-1.1200e-002	3.4264e-004	9.0495e-003
26	-2.7093e-002	-4.8383e-003	1.5449e-002
27	-1.8447e-002	1.1934e-002	1.2899e-002
28	-5.9571e-003	5.4806e-003	1.1004e-002
29	-2.6630e-002	-3.5683e-003	1.7662e-002
30	-2.2997e-002	-3.6388e-003	1.7948e-002
31	-1.2856e-002	8.7769e-003	1.4795e-002
32	-9.6629e-003	6.5546e-003	1.2248e-002
33	-3.7894e-004	-2.8049e-003	1.3581e-002

```
#####################################
End of Results of Structural Analysis
#####################################
```

Critical Column Design

Wide Flange

Longest unbraced section with highest axial load: 18 ft, 2760 lbs

Design Procedure							
1)	**Pu**	2.760	kips				
2)	**Assume KL**						
	KxLx:	1					
	KyLy:	1					
	Lx	28	ft				
	Ly	28	ft				
	KLx := Kx×Lcol	14					
	KLy := Ky×Lcol	14					
3)	**Assume Fcr**						
	Fy	50	ksi				
	Fcr=(2/3)Fy	33.33	ksi				
4)	**Calculate Areq**						
	Areq	0.09	in2				
5)	**Trial Section**						
	Choose:	W16x50	Based on AISC Column Table				
	Area	14.7	in2				
	Ix-x	659	in4				
	rx	6.68	in				
	ry	1.59	in				
	$(KL/r)_x$	25.1	DOES NOT GOVERN				
	$(KL/r)_y$	105.7	GOVERNS				
	Slenderness Check		OK				
	Klrmax<200?	YES					
6)	**Kx Determination**			**Ky Determination**			
	Columns	W16x50		Columns	W12x65		
	I	659	in4	I	174	in4	
	L	18	ft	L	18	ft	
	Beams	HSS7x7x1/2		Beams	HSS7x7x1/2		
	I	80.7	in4	I	80.7	in4	
	L	10.5	ft	L	10.5	ft	
	Gelastic top	5.954		Gelastic top	1.572		
	Pu/A	0.19	ksi	Pu/A	0.19	ksi	
	SRF	1	LOOKUP	SRF	1	LOOKUP	
	Ginelastic top	5.954		Ginelastic top	1.572		
	Gbottom	1.000		Gbottom	1.000		
	Kx	1.7	Sidesway Uninhibited	Ky	1.35	Sidesway Inhibited	
			AISC Figure C-C2.4			AISC Figure C-C2.3	
	$(KL/r)_x$	55.0	DOES NOT GOVERN				
	$(KL/r)_y$	183.4	GOVERNS				
	Elastic/Inelastic Limit	113.43					
		ELASTIC					
	Inelastic:			Elastic:			
	F_e	8.50	ksi	F_e	8.50	ksi	
	F_{cr}	4.26	ksi	F_{cr}	7.46	ksi	
7)	**Capacity**	98.64	kips				
		Adequate Section					
8)	**Check Slenderness**						
	$(Kl/r)_{max}$<200?	YES					
9)	**Check Compactness**			Limit			
	Flange, b/t	5.61	COMPACT	13.49	AISC Table B4.1 Case 3		
	Web, h/tw	35.86	COMPACT	35.88	AISC Table B4.1 Case 10		

Hollow Structural Shape (Tubing)

Longest unbraced section with highest axial load: 12 ft, 7431 lbs

Design Procedure							
1)	**Pu**	7.431	kips				
2)	**Assume KL**						
	KxLx:	1					
	KyLy:	1					
	Lx	12	ft				
	Ly	12	ft				
	KLx := Kx×Lcol	12					
	KLy := Ky×Lcol	12					
3)	**Assume Fcr**						
	Fy	50	ksi				
	Fcr=(2/3)Fy	33.33	ksi				
4)	**Calculate Areq**						
	Areq	0.25	in2				
5)	**Trial Section**						
	Choose:	HSS7x7x1/2	Based on AISC Column Table				
	Area	11.6	in2				
	Ix-x	80.5	in4				
	rx	2.63	in				
	ry	2.63	in				
	$(KL/r)_x$	54.8	DOES NOT GOVERN				
	$(KL/r)_y$	54.8	DOES NOT GOVERN				
	Slenderness Check		OK				
	Klrmax<200?	YES					
6)	**Kx Determination**			**Ky Determination**			
	Columns	HSS7x7x1/2		Columns	HSS7x7x1/2		
	I	80.5	in4	I	80.5	in4	
	L	12	ft	L	12	ft	
	Beams	HSS7x7x1/2		Beams	HSS7x7x1/2		
	I	80.7	in4	I	80.7	in4	
	L	31.5	ft	L	25,34	ft	
	Gelastic top	2.618		Gelastic tc	1.198		
	Pu/A	0.64	ksi	Pu/A	0.64	ksi	
	SRF	1	LOOKUP	SRF	1	LOOKUP	
	Ginelastic top	2.618		Ginelastic	1.198		
	Gbottom	1.000		Gbottom	1.000		
	Kx	1.55	Sidesway Uninhibited	Ky	1.32	Sidesway Inhibited	
			AISC Figure C-C2.4			AISC Figure C-C2.3	
	$(KL/r)_x$	84.9	GOVERNS				
	$(KL/r)_y$	72.3	DOES NOT GOVERN				
	Elastic/Inelasti	113.43					
		INELASTIC					
	Inelastic:			Elastic:			
	F_e	39.70	ksi	F_e	39.70	ksi	
	F_{cr}	29.51	ksi	F_{cr}	34.82	ksi	
7)	**Capacity**	308.13	kips				
		Adequate Section					
8)	**Check Slenderness**						
	$(Kl/r)_{max}<200$?	YES					
9)	**Check Compactness**			Limit			
	Flange, b/t	12.10	COMPACT	13.49	AISC Table B4.1 Case 3		
	Web, h/tw	12.10	COMPACT	35.88	AISC Table B4.1 Case 10		

Critical Beam Design
Longest tubular steel beam with highest moment: 34ft, -9937 lb-ft

Flexural Check

AISC Table 3-13 Available Flexural Design Strength: 96.4 kip-ft

96400 lb-ft > 9937 lb-ft SECTION ADEQUATE

Plastic Moment

$M_p = (F_y)(Z)$ = 46 ksi * 27.9 in^3 = 1283.4 k-in = 106.95 k-ft = 106950 lb-ft

ΦM_p = 0.9*106950 lb-ft = 96255 lb-ft

$\Phi M_p > M_u$ OK

Local Buckling

Flange Local Buckling: b/t = 12.10

$$\lambda_p = 0.38\sqrt{\frac{E}{F_y}} = 9.54$$

$$\lambda_r = 1.0\sqrt{\frac{E}{F_y}} = 25.1$$

$\lambda_p <$ b/t $< \lambda_r$ Noncompact Section

$$M_n = \left[M_p - \left(M_p - 0.7F_yS_x\right)\left(\frac{\lambda-\lambda_{pf}}{\lambda_{rf}-\lambda_{pf}}\right)\right] = 1194\ k\ in$$

ΦM_n = 0.9*1194 k in = 1074 k in = 89557 lb-ft

$\Phi M_p > M_u$ OK

Web Local Buckling: b/t = 12.10

$$\lambda_p = 3.76\sqrt{\frac{E}{F_y}} = 94.37$$

$$\lambda_r = 5.76\sqrt{\frac{E}{F_y}} = 144.57$$

b/t < λ_p Compact Section

Lateral Torsional Buckling

No lateral torsional buckling in HSS section because all cross-sectional elements are stiffened.

Cost Calculations

Preservation of Current Condition Costs

Window Size Chart							
		Width		Height			
	#	ft	in	ft	in	Area	
First Floor	1	5	0	3	0	17.78	SF
	2	2	7	6	0	18.47	SF
	3	2	7	6	0	18.47	SF
	4	3	2	6	0	22.17	SF
	5	2	10	6	0	20.06	SF
	6	3	2	6	0	22.17	SF
	7	3	2	6	0	22.17	SF
	8	3	2	6	0	22.17	SF
	9	2	7	3	0	9.72	SF
	10	3	8	3	0	13.33	SF
	11	3	8	3	0	13.33	SF
	12	3	8	3	0	13.33	SF
	13	3	8	3	0	13.33	SF
	14	3	8	3	0	13.33	SF
	15	3	0	1	7	6.39	SF
Second Floor	1	4	3	3	6	17.57	SF
	2	2	10	4	6	15.31	SF
	3	2	10	4	6	15.31	SF
	4	4	3	3	4	16.81	SF
	5	4	3	3	4	16.81	SF
	6	1	9	1	0	2.78	SF
	7	2	10	4	6	15.31	SF
	8	2	10	4	6	15.31	SF
	9	1	5	2	3.5	4.59	SF
	10	1	5	2	3.5	4.59	SF
Tower (Third and Fourth Floors)	1	3	0	7	0	24.44	SF
	2	1	5	2	3.5	4.59	SF
	3	1	5	2	3.5	4.59	SF
	4	1	5	2	3.5	4.59	SF
	5	1	5	2	3.5	4.59	SF
	6	1	5	2	3.5	4.59	SF
	7	2	0	3	0	7.78	SF
	8	2	0	3	0	7.78	SF
	9	2	0	3	0	7.78	SF
	10	2	0	3	0	7.78	SF
	11	2	0	3	0	7.78	SF
	12	2	0	3	0	7.78	SF
	13	1	5	3	0	5.83	SF
	14	1	5	3	0	5.83	SF
Total Area						476.34	SF

Door Size Chart							
		Width		Height			
	#	ft	in	ft	in	Area	
Small	1	3	0	7	0	21.00	SF
	2	3	0	7	0	21.00	SF
	3	3	6	7	0	24.50	SF
	4	3	7	5	0	17.92	SF
	5	3	0	7	0	21.00	SF
Garage	6	9	8	9	0	87.00	SF
	7	9	8	9	0	87.00	SF
	8	7	5	9	0	66.75	SF
	Total Area					346.17	SF

Preservation Cost Estimate

Item	Approximate Quantity		Unit	Unit Cost	Labor Cost	Spec	Cost Estimate
Roof Shingles	-		-	-	-		-
West Roof	855		SF	-	-	-	-
East Roof	1210		SF	-	-	-	-
Tower Roof	50		SF	-	-	-	-
TOTAL	2115		SF	10.92	24224	RS Means	$47,332
Windows	**Steel**	**LVR**	-	-	-	-	-
South Elevation	4	5	#	-	-	-	-
North Elevation	3	8	#	-	-	-	-
East Elevation	4	7	#	-	-	-	-
West Elevation	3	6	#	-	-	-	-
TOTAL AREA STEEL	246.22	-	SF	9.2	4802	RS Means	$7,207
TOTAL AREA LOUVERS	-	230.11	SF	37	6240	Arch Lvrs E4DS	$14,754
Small Doors	**Steel**	**LVR**	-	-	-	-	-
South Elevation	1	0	#	-	-	-	-
North Elevation	2	0	#	-	-	-	-
East Elevation	0	0	#	-	-	-	-
West Elevation	1	0	#	-	-	-	-
TOTAL AREA	105.42	x	SF	9.2	1372	RS Means	$2,382
Garage-Sized Doors	**Steel**	**LVR**	-	-	-	-	-
South Elevation	1	0	#	-	-	-	-
North Elevation	2	0	#	-	-	-	-
East Elevation	0	0	#	-	-	-	-
West Elevation	0	0	#	-	-	-	-
TOTAL AREA	240.75	x	SF	9.2	1029	RS Means	$3,244
Siding	-		-	-	-	-	-
South Elevation	30		SF	-	-	-	-
North Elevation	0		SF	-	-	-	-
East Elevation	10		SF	-	-	-	-
West Elevation	15		SF	-	-	-	-
TOTAL	55		SF	1.64	1.56	RS Means	$1,376
						Construction Contingency:	$18,730
						Engineering and Permitting:	$9,365
						Total:	$104,390

Preservation Cost Estimate

Item	Approximate Quantity		Unit	Unit Cost	Labor Cost	Spec	Cost Estimate
Roof Shingles	-		-	-	-		-
West Roof	855		SF	-	-	-	-
East Roof	1210		SF	-	-	-	-
Tower Roof	50		SF	-	-	-	-
TOTAL	2115		SF	10.92	24224	RS Means	$47,332
Windows	**Steel**	**LVR**	-	-	-	-	-
South Elevation	4	5	#	-	-	-	-
North Elevation	3	8	#	-	-	-	-
East Elevation	4	7	#	-	-	-	-
West Elevation	3	6	#	-	-	-	-
TOTAL AREA WOOD	246.22	-	SF	0.875	3122	Ace Hardware	$3,477
TOTAL LENGTH 2"x4"	129.17	-	LF	5		ACE Hardware	$646
TOTAL AREA LOUVERS	-	230.11	SF	37	6240	Arch Lvrs E4DS	$14,754
Small Doors	**Steel**	**LVR**	-	-	-	-	-
South Elevation	1	0	#	-	-	-	-
North Elevation	2	0	#	-	-	-	-
East Elevation	0	0	#	-	-	-	-
West Elevation	1	0	#	-	-	-	-
TOTAL AREA	105.42	x	SF	0.875	892	Ace Hardware	$1,024
TOTAL LENGTH 2"x4"	66.00	-	LF	5		ACE Hardware	$330
Garage-Sized Doors	**Steel**	**LVR**	-	-	-	-	-
South Elevation	1	0	#	-	-	-	-
North Elevation	2	0	#	-	-	-	-
East Elevation	0	0	#	-	-	-	-
West Elevation	0	0	#	-	-	-	-
TOTAL AREA	240.75	x	SF	0.875	1029	Ace Hardware	$1,240
TOTAL LENGTH 2"x4"	216.00	-	LF	5		ACE Hardware	$1,080
Siding	-		-	-	-	-	-
South Elevation	30		SF	-	-	-	-
North Elevation	0		SF	-	-	-	-
East Elevation	10		SF	-	-	-	-
West Elevation	15		SF	-	-	-	-
TOTAL	55		SF	1.64	1.56	RS Means	$1,376
				Construction Contingency:			$17,471
				Engineering and Permitting:			$8,735
				Total:			$97,466

Demolition Disposal Costs

INDUSTRIAL TECHNICAL SERVICE CENTER
PO BOX 7065
30 Rochester Neck Road
Rochester, NH 03839
Phone: (800) 963-4776
Fax: (866) 723-5761

QUOTE LETTER

April 22, 2009

Mr. Kyle Urso
Unh

Durham NH

Dear Mr. Urso

Waste Management is pleased to present this proposal for the disposal and/or transportation of approximately 1000 Cu Yards of Friable and Non Friable Asbestos. Pricing is as follows:

Disposal of Wood Island Non Haz Friable And Non Friable Asbestos at Turnkey Landfill

Treatment/Disposal Pricing:

Disposal Rate - Non Friable	$75.00	Ton	with	10	Ton Minimum Per Load	
Disposal Rate - Friable	$91.00	Ton	with	10	Ton Minimum Per Load	
Disposal Fuel Surcharge	Subject to Weekly Change				Current rate at time of quote is	2.82%
Environmental Fee					Applied to Invoice Total	6.00%

Transportation Pricing: Customer to Provide

plus attached schedule of fees and surcharges, when applicable.

Terms and Conditions:

All pricing is contingent upon the review and approval of the Generator's Waste Material Profile Sheet. The Waste Profile and all supporting documents must be completed and signed by an authorized signatory of the Generator and approved by a Waste Management authorized Approval Chemist.

All profiles must be approved by WM Approval Chemist and all Confirmation Letters must be signed by the customer and returned to WM prior to any loads being shipped into the landfill.

Waste Management reserves the right to refuse any load or discontinue any waste stream should such waste pose a threat to human health or safety, prove to be operationally challenging, or is in violation of any WM permit. This proposal is good for thirty (30) days. If not accepted in the allotted time, all pricing will expire.

Upon acceptance of the proposal, please contact me at your earliest convenience for the paperwork required to begin the approval process.

Thank you for the opportunity to provide you with this proposal. If you have any questions, please feel free to contact me at (603) 330-2101 .

Best regards,

Bryan Dexter
Technical Service Representative

Attachments

Quote Letter 1 of 2

SCHEDULE OF FEES

OPERATIONAL FEES

• RINSE OUT (LESS THAN 5 MINUTES)	$ 150.00 RINSE
• WASH OUT (1/2 HOUR MINIMUM)	$ 650.00 WASHOUT
• DIG OUT (1/2 HOUR MINIMUM)	$ 50.00 LOAD
• UNLOADING FEE (1/2 HOUR MINIMUM)	$ 350.00 HOUR
• SPECIAL HANDLING / BURIAL	$ 200.00 EACH
• WITNESSED DESTRUCTION	$ 100.00 EACH

(Washout fees apply to all vacuum trucks and tankers. Off-site truck washouts will be billed at cost plus 30%. Boxes / trucks will be washed / rinsed when applicable at customer's expense at the quoted above rates.)

MISCELLANEOUS FEES

• MANIFEST FEE	$ 2.00 EACH
• ADDITIONAL DOCUMENTATION-TICKET CC'S	$ 2.00 EACH

ABOVE RATES WILL BE CHARGED FOR THE ABOVE SERVICES WHEN REQUIRED. NO ESTIMATES WILL BE GIVEN BEFOREHAND, AS

SPECIAL CONDITIONS

- All loads are subject to Fuel Surcharge that is adjusted monthly to reflect the Department of Energy's monthly fuel prices for the last business day of the month.
- Non-conforming loads being rejected at the disposal facility will be charged a fee equal to the trip rate for returning the load.
- 24-hour notice for cancellation of scheduled transportation is required. A charge equal to the trip rate will be assessed for loads cancelled after the truck has been dispatched.

Waste must meet acceptability criteria at the site and comply with local, state and federal regulations, as well as the sites permit requirements. Pricing is contingent upon site and/or sample evaluation and approval.

Waste charged Per/Yard will be billed according to MANIFESTED VOLUME IN YARDS. In the case where the volume in yards is not recorded on the manifest you will be charged BASED UPON RATED CAPACITY OF THE CONTAINER.

Waste Management's Western Massachusetts Landfills strictly control capacity for soils that are utilized for daily cover needs. Projects will be accepted and approved on a case by case basis and awarded based on available capacity. Advanced scheduling of Loads is Required

Steel Frame Option Costs

	QUANTITY		MATERIAL COST		LABOR & EQUIP COST		INSTALLED COST	
ITEM DESCRIPTION	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
Environmental permitting & fees	1	LS	$4,500	$4,500	$6,000	$6,000	$10,500	$10,500
Engineering Design & Bid Documents	1	LS	$1,500	$1,500	$20,000	$20,000	$21,500	$21,500
Submittals & project management	1	LS	$600	$600	$12,000	$12,000	$12,600	$12,600
Construction								$207,305
Subtotal								$241,405
Contingency (25%)								$60,351
Subtotal								$301,756
Estimated Budget Amount								**$301,756**

CONSTRUCTION	QUANTITY		MATERIAL COST		LABOR & EQUIP COST		INSTALLED COST	
ITEM DESCRIPTION	NUMBER	UNIT	UNIT COST	TOTAL	UNIT COST	TOTAL	UNIT COST	TOTAL
1. Mobilization, demobilization, silt fence	1	LS	$1,000	$1,000	$3,000	$3,000	$4,000	$4,000
2. Demolition	1	CY						$75,000
3. Refuse Transport	800	CY						$24,000
3. Landfill Disposal	800	CY	$17.20	$13,760				$13,760
3. Backfill	1000	CY			$1.54	$1,540		$1,540
4. Foundation Installation	108	VLF	$13.1	$1,414.8	$42.5	$4,590		$6,005
5. Steel Erection	35470	LB	$1.9	$67,393	$0.44	$15,607		$83,000
Subtotal								$207,305
Page Subtotal								**$207,305**